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(21) International Application Number: PCT/GB98/01399 (22) International Filing Date: 28 May 1998 (28.05.98) (30) Priority Data: 9711140.5 30 May 1997 (30.05.97) GB (71) Applicant (for all designated States except US): KERRY INGREDIENTS (UK) LIMITED [GB/GB]; Thorpe Lea Manor, Thorpe Lea Road, Egham, Surrey TW20 8HY (GB). (72) Inventor; and (75) Inventor/Applicant (for US only): RUTTER, Jonathan, Simon [GB/GB]; 57 Partridge Chase, Bicester OX6 0XP (GB). (74) Agents: PRICE, Vincent, Andrew et al.; Fry Heath & Spence, The Old College, 53 High Street, Horley, Surrey RH6 7BN (GB).		(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, GM, GW, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG). Published <i>With international search report.</i> <i>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>
(54) Title: NON-FRIED COATINGS COMPRISING A BROWNING AGENT (57) Abstract A process for producing a coated food stuff having a fried appearance comprising the steps of coating the food stuff, disposing a browning agent at the surface of the coated food stuff and dry heating the coated food stuff to flash cook the surface, thereby imparting a fried appearance to the coated food stuff.		

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NON-FRIED COATINGS COMPRISING A BROWNING AGENT

The present invention relates to coatings for foodstuffs and to processes for producing coated foodstuffs. In particular, the invention relates to low fat coated foodstuffs having a fried appearance.

Conventional frying of various foodstuffs produces cooked foods having excellent visual appeal, mouthfeel and organoleptic qualities. However, the safety implications when used on an industrial scale are considerable and disposal of the spent fats expensive and difficult. Moreover, the use of oils in the frying process leads to relatively high inclusion levels of fats in the fried products (oil uptake is difficult to control in the frying process), so reducing their appeal to a significant number of consumers.

There is therefore a need for food products which have the desirable visual appeal, mouthfeel and organoleptic qualities of conventionally fried products, but which do not suffer from these disadvantages.

According to the present invention there is provided a process for producing a coated foodstuff having a fried appearance, the process comprising the steps of coating the foodstuff, disposing a non-enzymic browning agent (e.g. a Maillard browning agent) at the surface of the coated foodstuff and dry heating the coated foodstuff to flash cook the surface thereof, thereby imparting a fried appearance to the coated foodstuff (e.g. by activating the browning agent).

The term "browning agent" is used herein to define any agent which imparts brown colour (either as a colourant or as a colour generating precursor which produces colour during further processing). The brown colour imparted by the browning agent may be any of a number of hues ranging from yellows through golden browns to near-black dark browns which are substantially mimetic of the colours normally generated in deep fried products by *inter alia* caramelization and/or the Maillard reaction.

As used herein, the term "dry heating" is used to indicate that the foodstuff is heated without full or partial immersion in a heat conducting liquid (such as water or oil). Thus, the process of the invention does not involve a conventional frying or boiling step (but may involve certain steam treatments).

The dry heating may take any form, so long as rapid surface heating (flash cooking) of the surface of the food coating is achieved. Those skilled in the art

will appreciate that such flash surface cooking often leaves the core of the foodstuff substantially uncooked, which has advantages in many applications. In preferred embodiments, the dry heating is achieved through the use of a radiative primary heat source (as oppose to the use of a conducting oil as primary heat source in e.g. deep fat frying).

Any suitable form of dry heating may be used. In preferred embodiments, the dry heating is effected by medium wave, long wave or short wave infrared radiation (e.g. modulated or pulsed medium wave, long wave or short wave infrared radiation). Other suitable forms of heating include those delivered by impingement, radiofrequency and microwave ovens (the latter especially useful when frozen food portions are processed).

The process of the invention is ideally suited to the production of low or reduced fat products which appear to have been deep fried. Thus, in preferred embodiments, the coated foodstuff is a reduced or low fat foodstuff.

As used herein, the term "low fat" is used to denote a foodstuff which has less than 10% total fat. Particularly preferred are low fat products having up to 5% (e.g. up to 3%) fat. The term "reduced fat" is used to denote products having lower fat concentrations relative to their conventionally pre-fried counterparts.

The coating used in the invention may take any form, so long as it mimics a fried coating after processing.

Preferably, the coating is a batter (for example an adhesion batter). Other suitable coatings include crispy particulate coatings (such as crumb coatings, for example comprising comminuted vegetables, cheese or potato). Also useful are breadcrumb coatings (such as Japanese crumb), though so-called "novel" crumbs are particularly preferred.

The coating may have one or more inclusions incorporated therein, such as for example herbs, spices, seasonings, nuts, fruit, cheese, vegetables etc. Indeed, the dry heating processes of the invention (particularly those involving use of infrared heating) result in products with superior organoleptic properties, the inclusions retaining much of the flavour, colour and aroma that is usually lost or impaired during deep fat frying.

The coating is conveniently a combination of adhesion batter and crispy particulate coating, in which the crispy particulate coating is disposed on the batter.

Particularly suitable for the processes of the invention are adhesion batters which comprise a non-starch polysaccharide (e.g. gums such as gelatine, agar-agar and/or guar) or a coagulable protein (e.g. albumin and/or whey protein). Such batters have surprisingly been found to be particularly effective in maintaining the structural integrity of the coating during processing.

For some foodstuffs (particularly those with relatively high levels of surface moisture), the coating is preferably a laminate comprising a predust in immediate contact with the food surface, an adhesion batter disposed on the predust and a crispy particulate coating disposed on the batter.

The predust compositions for use in the invention may comprise a finely-divided moisture absorbing component (such as pregelatinised rice, flour and/or bread crumb fines). They may conveniently include a suitable flavouring agent. Thus, any of a wide range of commercially available predust compositions may be used according to the invention.

The outer surface of the coating preferably comprises a fat or oil to improve the mouthfeel of the foodstuff. In such embodiments, the fat or oil is conveniently disposed at the outer surface of the coating as a constituent of the browning agent, which may be directly applied to the surface of the coating (for example by spraying onto the surface of the coating).

The term "Maillard browning agent" is a term of art which defined a broad class of functional food ingredients which produce colour when activated by heat due to the induction of the Maillard reaction as described in e.g. US 4,886,659 (the teachings of which are incorporated herein by reference).

Particularly preferred for use in the process of the invention is either aqueous solubilised browning agent or an emulsion of aqueous solubilised browning agent in an oil. In such embodiments, the emulsion preferably comprises about 40-90%, e.g. 70-80% oil and 10-60 (e.g. 20-30%) of an aqueous solution of browning agent.

Alternatively, the browning agent may be associated with (e.g. adsorbed on or absorbed into) a carrier. In such embodiments, the carrier is preferably an absorbent solid particulate carrier, for example a crispy particulate coating (e.g. a breadcrumb).

In preferred embodiments, the browning agent comprises: (a) a carbonyl compound (e.g. dihydroxyacetone and/or hydroxyacetaldehyde), a sugar (e.g. a

monosaccharide), an alkali (e.g. sodium bicarbonate) and/or an acid (e.g. citric acid); and/or (b) a liquid smoke composition; and/or (c) a dextrose pyrolysis product.

The term "liquid smoke" is a term of art defining a wide variety of complex mixtures of chemicals produced during pyrolysis of organic matter. A summary of the many constituents found in liquid smoke is listed by Maga in "Smoke in Food Processing", CRC Press, pages 61-68 (1968). Suitable liquid smoke compositions for use in the invention are described in EP 0 494 966 A (the teachings of which are incorporated herein by reference).

The dry heating comprises exposure to infra-red in the long, medium or short wave frequencies or radiofrequency heating. However, any suitable heating may be employed, including convection, microwave, grilling or impingement oven cooking.

The degree and duration of heating depends on many different parameters, including *inter alia* the surface texture of the foodstuff, its emissivity and the composition of the batter. The optimum settings can be determined by those skilled in the art by routine trial and error, but in preferred embodiments with protein-based adhesion batters the dry heating step may heat the surface of the foodstuff to about 70-200°C, e.g. 90-180°C for up to 120 seconds (e.g. about 30-60 seconds).

The dry heating may set the coating, reduce the moisture content and/or produce browning (although it should be noted that the browning agent of the invention may impart the desired brown colour ab initio, without the need for further colour development during surface heating).

Preferably, the dry heating does not substantially cook the core of the foodstuff so that the coated products can be supplied in an uncooked (or partially cooked) form.

In another aspect, the invention relates to a functional crispy particulate coating (e.g. comprising comminuted vegetables, oat bran, cereal, cheese, potato and/or breadcrumb), especially crumb having absorbed therein (or adsorbed thereon) the browning agent of the invention. The coating may also comprise inclusions such as for example herbs, spices, seasonings, nuts, fruit, cheese, vegetables etc. Such crispy particulate coatings find particular application in the processes of the invention, and eliminate the need to apply the browning agent (e.g. by spraying) as a separate step.

The invention also contemplates a coated food product obtained by (or obtainable by) the process of the invention, as well as food products comprising the functional crispy particulate coating of the invention.

Also contemplated by the invention is a system for use in the process of the invention comprising: (a) a browning agent (e.g. as defined above); (b) an adhesion batter (e.g. as defined above); (c) a crispy particulate coating (e.g. as defined above); and optionally (d) a predust (e.g. as defined above) and/or a maillard browning agent (as defined above).

Alternatively, the system may comprise: (a) the functional crispy particulate coating described above; and (b) an adhesion batter (e.g. as described above); and optionally (c) a predust (e.g. as defined above) and/or a maillard browning agent (as defined above).

In another aspect, the invention contemplates a process for producing a low fat snack comprising coating the snack with oil and/or a browning agent (preferably aqueous browning agent) as defined herein and subjecting the snack to the dry heating process (as defined herein). The aforementioned invention finds application in the production of any of a wide range of snacks, including (for example) starch-based snacks, sliced potatoes (crisps), prefabricated snacks and extruded snacks.

The invention will now be described by reference to several Examples. These Examples are purely exemplary and are not intended to be limiting in any way. All percentages stated are on a dry weight basis, unless otherwise indicated.

Example 1: Adhesion batter

Wheat flour	50%
Maize flour	10%
Starch	6%
Wheat gluten	7%
Egg white	15%
Whole egg	5%
Salt	6%
Na bicarbonate	1%

Example 2: Predust

Crumb fines	92%
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Salt	5%
Pepper	1%
Herbs & spices	2%

Example 3: Maillard browning agent

The ingredients listed below were blended together to yield an emulsion.

Oil:	72%
Browning agent	11%
Water	12%
Flavour	3%
Emulsifier*	2%

* Polyglycerolpolyricinoleate (PGPI 90™, Danisco)

Example 4: Chicken in breadcrumbs

Pieces of chicken were coated with the predust composition described in Example 2. The dusted chicken pieces were then dipped into an adhesion batter prepared as described in Example 1. The battered chicken pieces were then coated with breadcrumbs. Finally, the Maillard browning agent emulsion prepared as described in Example 3 was sprayed onto the breadcrumbs.

The coated chicken pieces were then passed through a medium wave infrared oven. This flash surface heating set the batter, activated the browning agent (to yield a golden brown "fried" colour) and reduced the moisture content of the coating to yield a crisp texture.

Chicken pieces having an excellent crisp surface texture and good golden brown colour were produced. The products resembled flash fried products, but had a very low fat content. They could be cooked in a convection or microwave combination oven.

CLAIMS:

1. A process for producing a coated foodstuff having a fried appearance, the process comprising the steps of:
 - (a) coating the foodstuff;
 - (b) disposing a browning agent (e.g. a Maillard browning agent) at the surface of the coated foodstuff;
 - (c) dry heating the coated foodstuff (e.g. in an infra-red oven) to flash cook the surface thereof, thereby imparting a fried appearance to the coated foodstuff (e.g. by activating the browning agent).
2. The process of claim 1 wherein the coated foodstuff is a reduced or low fat foodstuff (for example having up to 5% (e.g. up to 3%) fat).
3. The process of claim 1 or claim 2 wherein the coating comprises a batter (e.g. an adhesion batter).
4. The process of any one of the preceding claims wherein the coating comprises a crispy particulate coating (for example a breadcrumb, e.g. Japanese crumb).
5. The process of claim 4 wherein the coating comprises an adhesion batter having crispy particulate coating disposed thereon.
6. The process of any one of claims 3-5 wherein the batter is an adhesion batter comprising a coagulable protein (e.g. albumin and/or whey protein).
7. The process of any one of the preceding claims wherein the coating comprises a predest at the surface of the foodstuff, an adhesion batter disposed on the predest and a crispy particulate coating disposed on the batter.
8. The process of any one of the preceding claims wherein the outer surface of the coating comprises a fat or oil.
9. The process of claim 8 wherein the fat or oil is disposed at the outer surface of the coating as a constituent of the browning agent.
10. The process of any one of the preceding claims wherein in step (b) the browning agent is provided by direct application to the surface of the coating (for example by spraying onto the surface of the coating).

11. The process of any one of the preceding claims wherein the browning agent:
 - (a) comprises an emulsion of aqueous solubilised browning agent in an oil; or
 - (b) is associated with (e.g. adsorbed on or absorbed into) a carrier.
12. The process of claim 11 (a) wherein the emulsion comprises about 40-90%, e.g. 70-80% oil and 10-60%, e.g. 20-30% of an aqueous solution of browning agent.
13. The process of claim 11 (b) wherein the carrier is a solid particulate carrier.
14. The process of claim 13 wherein the carrier is a crispy particulate coating (e.g. for example a breadcrumb, e.g. a Japanese crumb).
15. The process of any one of the preceding claims wherein the browning agent comprises a Maillard browning agent, for example:
 - (a) a carbonyl compound (e.g. dihydroxyacetone and/or hydroxyacetaldehyde), a sugar (e.g. a monosaccharide), an alkali (e.g. sodium bicarbonate) and/or an acid (e.g. citric acid); and/or
 - (b) a liquid smoke composition; and/or
 - (c) a dextrose pyrolysis product.
16. The process of any one of the preceding claims wherein the dry heating comprises irradiation, for example medium wave infra red radiation.
17. The process of any one of the preceding claims wherein the dry heating sets the coating and/or reduces the moisture content thereof and/or browns the coating.
18. The process of any one of the preceding claims wherein the dry heating does not substantially cook the core of the foodstuff.
19. A crispy particulate coating (for example a breadcrumb, e.g. Japanese crumb) having absorbed therein (or adsorbed thereon) the browning agent as defined in any one of the preceding claims.
20. A coated food product obtained by (or obtainable by) the process of any one of claims 1-18, or comprising the crispy particulate coating of claim 19.
21. A coating ingredient system for use in the process of any one of claims 1-

18 comprising:

- (a) a browning agent (e.g. as defined in any one of claims 1-18);
- (b) an adhesion batter (e.g. as defined in any one of claims 1-18);
- (c) a crispy particulate coating (e.g. as defined in any one of claims 1-18);
and optionally
- (d) a predest (e.g. as defined in any one of the preceding claims).

22. A coating ingredient system for use in the process of any one of claims 1-18 comprising:

- (a) a crispy particulate coating as defined in claim 19; and
- (b) an adhesion batter (e.g. as defined in any one of claims 1-18); and
optionally
- (c) a predest and/or a browning agent (e.g. as defined in any one of the preceding claims).

23. The invention of any one of the preceding claims wherein the foodstuff is a meat (e.g. fish, poultry or red meat), a vegetable (e.g. cereal, potato, pea, lentil, mushroom or onion) or dairy product (e.g. cheese).

24. A process for producing a low fat snack comprising coating the snack with oil and/or a browning agent (for example a browning emulsion) as defined in any one of the preceding claims and subjecting the snack to the dry heating process as defined in any one of the preceding claims.

INTERNATIONAL SEARCH REPORT

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B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 A23P A23L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 943 438 A (ROSENTHAL SALLIE W) 24 July 1990 see claims 1,3 see column 2, line 39 - line 48 see column 3, line 1 - column 4, line 65 see column 5, line 63 - column 6, line 38 ---	1-11, 13, 14, 16-24
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Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

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